Volar locking plates with screw fixation are noninferior to headless compression screws for surgical fixation of scaphoid fractures.

Joshua Ulmer Hancock[1], Peter Simon, Tantien Nguyen, Humberto Cardona, Jordan Henry Larson, Rachel Elizabeth Becker, Alfred V Hess
[1]Translational Research

INTRODUCTION:

Surgical fixation of scaphoid fractures is commonly performed utilizing a headless compression screw (HCS), yet recent studies have shown biomechanical and clinical benefits of volar locking plate with screw (VLP) fixation. The present study hypothesized that VLP would be noninferior to HCS in scaphoid fractures when comparing intraoperative and radiographic data and patient outcomes.

METHODS:

This single-institution, multi-surgeon retrospective study identified patients with scaphoid fracture fixations utilizing CPT codes 25440 and 25628. Inclusion criteria included surgical treatment of an isolated scaphoid fracture with VLP or HCS fixation in patients aged 18-90 years from 2019-2024. A total of 179 patients were identified, with 102 meeting selection criteria. A primary combined noninferiority analysis of VLP versus HCS fixation in all scaphoid fractures was performed, with sub-analyses comparing both fixation types in 1) acute fractures (time to surgery (TTS) < 180 days) and 2) chronic nonunions (TTS ≥ 180 days). The primary analysis was powered using a one-sided test with an alpha of 0.05, a beta of 0.80, a noninferiority margin of 12.5%, expected outcome of 85% union rate, and an unequal group ratio of 3:1. We determined that the control (HCS) group needed at least 69 subjects while the experimental (VLP) group needed at least 22 subjects.

RESULTS:

Of the fractures, 77 (75.5%) received HCSs (Figure 1) while 25 (24.5%) received VLPs (Figure 2). VLPs were used in more severely displaced fractures and chronic nonunions ($p \leq 0.029$), while HCSs had a shorter TTS ($p = 0.007$, Table 1). Additional surgery rates, length of immobilization (LOI), length of follow-up (LOFU), and changes in QuickDASH scores were similar ($p \geq 0.394$), while HCSs had shorter operative and tourniquet times ($p < 0.001$). Radiographic union rates (HCS: 84.9%, VLP: 86.4%) and time to union (TTU) were noninferior across fixation types ($p \geq 0.310$, Table 2). On subgroup analysis, the fractures were 68 (66.7%) acute and 34 (33.3%) chronic nonunions and experienced noninferior LOI, LOFU, and changes in QuickDASH scores when treated with either fixation technique ($p \geq 0.329$, Table 3). Fixation types experienced noninferior radiographic union rates and TTU across fracture acuities ($p \geq 0.301$, Table 3).

DISCUSSION AND CONCLUSION:

While HCSs are the standard fixation technique in scaphoid fractures, the present study suggests VLPs are a noninferior surgical alternative. With similar patient outcomes despite higher rates of nonunion, more severe displacement, and longer TTS, VLPs should be considered in properly indicated patients without concern for inferior outcomes across fracture acuities. However, longer operative and tourniquet times can be expected, so HCSs may remain the superior choice in nondisplaced or mildly displaced acute fractures.